comprising use of a bleaching solution containing peracid and having a pH within the range of 3-8, in the presence of one or several earth-alkali metal compounds, the peracid turning colorless chromophoric groups in the pulp.

REMARKS

Reconsideration of this application as amended is respectfully submitted.

New Claims 17 and 18 have been added. Claim 17 depends on Claim 1 and is directed to the embodiment wherein the peracid is used to turn colorless chromophoric groups in the pulp. Claim 18 is directed to a method for the bleaching of chemical pulp, comprising treating the pulp in a sequence of different steps at a bleaching plant and, finally, in a post-bleaching step in a pulp flow pipe during transfer of the pulp, in a storage tower or at a paper mill outside the bleach plant, said post-bleaching being subjected to a pulp having a kappa number at maximum 4 and comprising use of a bleaching solution containing peracid and having a pH within the range of 3-8, in the presence of one or several earth-alkali metal compounds, the peracid turning colorless chromophoric groups in the pulp. Support for Claims 17 and 18 is found in the specification, for example, at page 4, lines 13-21 and 33-36.

Claim 3 has been cancelled in this Amendment. Applicants intended to cancel Claim 3 in the previous Amendment filed herein, but due to a typographical error, erroneously did not do so. However, the subject matter of Claim 3 was incorporated into Claim 1 as amended in the previously filed Amendment herein. The cancellation of Claim 3 renders moot the rejection applied to former Claim 3 under 35 U.S.C. §112, second paragraph, as being indefinite, and withdrawal of such rejection is respectfully requested.

As now claimed, in one aspect (Claim 1), applicants' invention is directed to an

improvement in a method for the bleaching of chemical pulp, wherein the pulp is treated in a plurality of different steps and wherein at least in one step a bleaching solution which contains a peracid is used. The improvement claimed in the method is using the peracid in a post-bleaching which is the last step of the bleaching process, the post-bleaching taking place in the presence of one or several earth-alkali metal compounds, the pH of the post-bleaching solution is in the range of 3-8, and the kappa number of the pulp before the post-bleaching with a peracid is at maximum 4.

In another aspect (Claim 18), applicants' invention is directed to a method for the bleaching of chemical pulp. The method comprises treating the pulp in a sequence of different steps at a bleaching plant and, finally, in a post-bleaching step in a pulp flow pipe during transfer of the pulp, in a storage tower or at a paper mill outside the bleach plant. The post-bleaching is applied to a pulp having a kappa number at maximum 4 and comprises use of a bleaching solution containing peracid and having a pH within the range of 3-8, in the presence of one or several earth-alkali metal compounds. The peracid turns colorless chromophoric groups in the pulp.

Post-bleaching is applied to pulp for which the delignification process proper in a bleach-plant is already finished. A high degree of delignification, a high brightness and a low kappa number are attained by applicants' claimed method. The purpose of post-bleaching is to compensate for the decrease of brightness and thereby avoid the need of overbleaching in the delignification process. Overbleaching is disadvantageous because it results in a high consumption of chemicals. Preferably, post-bleaching is carried out outside the bleach plant in a pulp flow piper or a storage tower or at a paper machine.

Applicants' claimed invention is directed a method for the bleaching of chemical

pulp in which peracid is used in combination with at least one earth-alkali metal compound at the post-bleaching step. The claimed method brings about an increase of brightness while the use of the earth-alkali metal compound effectively counteracts the adverse effect peracid alone would have on the viscosity and strength of the pulp. This has been shown in the working examples.

Claims 1-7 and 9-16 have been rejected under 35 U.S.C.§103(a) as being obvious over U.S. Patent No. 3,865,685 to Hebbel, et al., in view of WO 97/45586 with or without U.S. Patent No. 4,222,819 to Fossum, et al. The primary reference, Hebbel, et al., is clearly deficient. The Office Action argues that Hebbel, et al. describe 3-stage and 5-stage (in Example VIII) bleaching sequences starting with, e.g., peracetic acid and ending with a final post-bleaching stage with use of a per compound.

However, the per compound that Hebbel, et al. state is preferred and which they describe in the examples is hydrogen peroxide, not peracetic acid. Hebbel et al.'s teaching of bleaching with hydrogen peroxide in NaOH under strongly alkaline conditions does not teach or suggest applicants' claimed method in which the final post-bleaching step is carried out with a peracid within a pH range of 3-8. Hebbel, et al. teach a bleaching solution containing besides hydrogen peroxide also 1.0% of NaOH. Such a solution is strongly alkaline, having a pH well above 8. Hebbel, et al., therefore, do not teach or suggest post-bleaching with peracid in acidic or neutral conditions as specified by the claimed pH range of 3 to 8.

The Office Action argues that even though Hebbel et al. uses hydrogen peroxide and not per acids in the examples, "the discosure of a reference is not limited to its Examples" and Hebbel et at. "clearly teach that per acids could be used as a substitute for the hydrogen peroxide" (Office Action dated March 6, 2002, p.4). Hebbel et al.'s inclusion of some per acids in a listing of per compounds (col. 2, lines 30-43) does not teach or suggest their use in a final

bleaching step as a substitute for hydrogen peroxide. No competent chemist would consider using peracid instead of hydrogen peroxide for the final bleaching step because Hebbel et al. teach that such step is carried out under strong alkaline conditions. Peracid would require an acidic or neutral pH range, which would be contrary to the teachings of Hebbel et al. regarding their final bleaching stage. Hebbel et al. make a general teaching to having an alkaline final step at column 1, line 63, and exemplify such general teaching in their examples, wherein each time hydrogen peroxide is used for the final bleaching step, the conditions are strongly alkaline.

Moreover, Hebbel et al. state that "The amount of per compound added can be between 0.5 and 10 weight percent, preferably between 0.5 and 6 weight percent, calculated as 100 percent hydrogen peroxide and based on the oven dry calculated weight of the cellulose used." (column 2, lines 45-49). This does not teach or suggest using peracid in the post-bleaching step, for example, in an amount between 0.5 and 3 kg/tp as specifically claimed by applicants in Claim 13. Applicants have surprisingly found that even when using "a very small peracetic acid dose, 0.5-3 kg/tp, the results of applicants' method are obtained, and that larger doses are even detrimental. See applicants' specification at page 4, lines 23-28.

The Office Action also argues that Hebbel et al. "further teaches that a magnesium sulphate (alkaline earth compound) can be used as a complex builder or stabilizer." Office Action dated March 6, 2002, p. 2. However, the disclosed use of an earth alkali metal compound in the Hebbel et al. bleaching process is general and vague. There is no specific teaching of use of an earth alkali metal compound in a final peracid post-bleaching step, much less a teaching of such bleaching in neutral or acid conditions, applied to a pulp having a kappa number of 4 of less.

The Office Action further argues that the teaching in Example VIII of Hebbel et

al. of bleaching pulp in a 5-stage bleaching processes is properly combinable with, and can be interpreted in light of, the teaching in Example VII of Hebbel et al. that after four stages of the Hebbel et al. bleaching process, "the brightness is over 90% MgO (Example VII)." Office Action dated March 6, 2002, p. 2. From the teaching that the first 4 stages of the bleaching process described in Example VII produce a pulp with a brightness over 90% MgO, the Office Action concludes that "It would have been obvious to the routineer that after the first 4 stages of [the bleaching process described in Example VIII of] HEBBEL the brightness [of the pulp] would be above 85% ISO and [the pulp would have] a kappa number less than 4 as HEBBEL teaches that after 4 stages the brightness is over 90%." Office Action dated March 6,, 2002, p. 2.

However, the Office Action's argument that the first four stages would obviously produce a kappa number less than 4 is simply an unsupported assertion. Further the Office Action's and conclusions of the Office Action are based on the incorrect premise that the teachings of Examples VII and VIII of Hebbel et al. are properly combinable in the manner done by the Office Action. They are not. The first four stages of the bleaching process described in Example VIII of Hebbel et al. are markedly different from the first four stages of the bleaching process described in Example VII of Hebbel et al. Thus, they are not properly combinable in the manner done in the Office Action. Moreover, there is no description in either Example VII or VIII of Hebbel et al. of a bleaching process for pulp subjected to a final peracid post-bleaching step that produces a pulp having a kappa number of 4 or less. Neither Example VII or VIII of Hebbel et al. teaches or suggests a bleaching process as claimed by applicant that produces a pulp having a kappa number of 4 or less.

Kappa number and brightness are two different parameters of pulp, which in principle do not depend on each other. Kappa number is a measure of the degree of

delignification of a pulp, whereas brightness is merely a matter of its color. Even though a decreasing kappa number usually brings about an increasing brightness, there are other ways to increase brightness than delignification, and brightness can change with time. Consequently, brightness is not an adequate basis for gauging the kappa number with any certainty. Furthermore, applicants' invention as claimed required that the kappa number of 4 or less has been reached before the final peracid post-bleaching step. There is no teaching or suggestion of such in Hebbel etl al.

The Office Action further argues that "It would have been obvious to bleach the pulp at any point where pulp is normally bleached, e.g. flow pipe, storage tower or on the paper machine (Office Action dated March 6, 2002, p.2). Post-bleaching in a flow pipe or storage tower, or on the paper machine are the subject matter of claim 9-11. These are the specific locations for the post-bleaching according to applicants' invention. Hebbel et al. do not refer to such separately performed final bleaching in any manner whatsoever. Rather, Hebbel et al. describe only bleaching that is performed in an ordinary bleaching plant. Claims 9-11 in particular are remote from Hebbel et al. as well as the other references cited in the Office Action. Applicants' invention improves post-bleaching performed separately outside the sequential bleaching that is performed in an ordinary bleaching plant. Thus, it would not be obvious to modify the teachings of Hebbel et al. to bleach the pulp in a flow pipe, storage tower or on a paper machine without applying hindsight gleaned from applicants' disclosure which is improper.

As regards "complete" bleaching accordingly to Hebbel et al. and post-bleaching, the Office Action's argument that "the last per-stage of HEBBEL would be a "post-bleach" stage as it comes after the other bleaching stages" (Office Action dated March 6, 2002, p. 4) only

highlights the difference between applicants' invention as claimed and the bleaching described by Hebbel et al. Hebbel et al.'s complete bleaching is a close sequence of subsequent steps typically performed at a bleaching plant. Such a sequence achieves a high degree of delignification, that is a low kappa number, as well as a high brightness. Hebbel et al. teach that nothing more needs to be done for the pulp. However, after such "complete" bleach, the brightness of the pulp may lower during storage, and post-bleaching is a measure taken to remedy this. Post-bleaching is typically carried out separately after the pulp has left the bleaching plant, and works by turning the pulp's chromophoric groups colorless rather than reducing the already very low residual lignin in the pulp. This is a clear difference from the cited references, which teach use of per compounds specifically for removing lignin from the pulp. See applicants' specification at page 4, lines 13-21. Moreover, new Claims 17-18 specifically recite that the peracid is used to turn colorless chromophoric groups in the pulp in the post-bleaching step.

For these reasons, applicant respectfully submits that Claims 1-2, 4-7 and 9-18 define patentable subject matter over the teaching of Hebbel et al. Withdrawal of the rejection of such claims under 35 U.S.C. §103(a) as obvious over Hebbel et al. is respectfully requested.

The teaching of the secondary reference, WO 97/45586, does not cure the above stated deficiencies of the primary reference, Hebbel et al. WO 97/45586 describes a peracid step in the pH range of 4-8, but this step is not a post-bleaching step as there is always a subsequent alkaline step closing the bleaching sequence. According to the tables, the pH of the final alkaline step is within the range of 9-11. Considering that Hebbel et al.'s final peroxide step is always alkaline through the use of strong NaOH, there is nothing to suggest turning the final steps to the acidic or neutral Ph range, i.e. to a pH of 8 or less.

Furthermore, WO 97/45586 nowhere applies peracid bleaching to pulp having a kappa number of 4 or less. The initial kappa numbers in WO 97/45586 are always higher, namely 4.9 or 5.6 according to tables 5 and 6. There are lower kappa numbers mentioned in the tables, but these are values resulting from the peracid step, and are not initial values. This does not teach or suggest applicants' claimed invention as claimed in which the kappa number is required to be at maximum 4 before the final post-bleaching. Thus, WO 97/45586 does not supply the deficiencies of Hebbel et al. and their combination does not teach or suggest applicants' invention as now claimed in Claims 1-2, 4-7 and 9-16 as amended.

Moreover, the combination of Hebbel et al. and WO 97/45586 does not teach or suggest a bleaching process in which the amount of peracid used for post-bleaching is 0.5 to 3 kg/tp, as claimed by applicant in Claim 13. For example, in WO 97/45586, the amount of peracid used for post-bleaching is always at least 5 kg/tp. For these reasons, applicant respectfully submits that Claims 1-2, 4-7 and 9-16 define patentable subject matter over the combined teachings of Hebbel et al. and WO 97/45586. Withdrawal of the rejection of such claims under 35 U.S.C. §103(a) as obvious over Hebbel et al. in view of WO 97/45586 is respectfully requested.

Claims 1-2, 4-7 and 9-16 also have been rejected under 35 U.S.C.§103(a) as being unpatentable over Hebbel, et al. in view of WO 97/45586 , and further in view of U.S. Patent No. 4,222,819 to Fossum, et al. The deficiencies of the primary references, Hebbel et al. and WO 97/45586, are set forth above. Fossum, et al. do not cure these deficiencies. Fossum et al. has been cited as describing the use of certain calcium salts instead of magnesium salt (Office Action dated March 6, 2002, p.4). For the reasons set forth above, Claims 1-2, 4-7 and 9-16, as well as Claime 17-18 are believed to define patentable subject matter. Withdrawal of the rejection

applied to Claims 1-2, 4-7 and 9-16 under 35 U.S.C.§103(a) as being unpatentable over Hebbel, et al. in view of Fossum, et al. is respectfully requested.

In light of the foregoing, applicant respectfully submits that Claims 1-2, 4-7 and 9-18 as amended define patentable subject matter over the prior art of record, alone or in combination. Allowance of all Claims is earnestly solicited.

Respectfully submitted,

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